WHAT IS CLAIMED IS:

1. A drive mechanism control apparatus, comprising:

a driver;

a drive controller in communication with the driver;

a data generator for generating control data for controlling the driver, and for generating timing data for controlling output timing of the control data to the drive controller, wherein the drive controller controls operation of the driver based on the transmitted control data;

a storage medium for storing the timing data and control data;

a timer for starting a timing operation upon receipt of timing data, and for outputting a time-up signal when a time specified by the received timing data elapses;

a first direct memory access for reading the timing data from the storage medium, and for sending the read timing data to the timer when activated by a specific signal; and

a second direct memory access for reading control data from the storage medium, and for sending the read control data to the drive controller when the time-up signal is received from the timer.

2. A drive mechanism control apparatus as recited in claim 1, wherein

the data generator is configured to generate plural timing data and plural control data corresponding to the plural timing data;

the second direct memory access is configured to output to the first direct memory access a start signal to cause the first direct memory access to start reading second timing data after the second direct memory access completes the sending of control data corresponding to the first timing data to the drive controller; and

the first direct memory access is configured to read the second timing data from the storage medium and send the second timing data to the timer based on the start signal.

3. A drive mechanism control apparatus as recited in claim 2, wherein the second direct memory access further comprises:

a first control unit, activated by the time-up signal from the timer, for reading, from among plural control data stored to the storage medium, first control data corresponding to the first timing data each time the time-up signal is received, and for sending the read first control data to the drive controller; and

a second control unit, activated by completion of sending the first control data, for reading, from among the plural control data stored to the storage medium, second control data corresponding to the second timing data, for sending the read second control data to the drive controller, and then for outputting the start signal to the first direct memory access.

4. A drive mechanism control apparatus as recited in claim 1, further comprising:

a stepping motor;

wherein the timing data comprises timing data for controlling a phase change timing of the motor, and the control data comprises phase pattern data that is set when the motor phase changes and phase current data for controlling current supplied to the motor when the motor phase changes.

5. A drive mechanism control apparatus as recited in claim 4, wherein the data generator generates basic timing data, phase pattern data, and phase current data for use during motor acceleration, deceleration, and constant speed operation, and generates the timing data, first control data, and second control data based on the basic timing data.

6. A drive mechanism control apparatus as recited in claim 1, further comprising:

a head drive;

wherein the timing data and control data comprises data controlling head drive timing, drive trigger data for actually driving the head, and print data.

7. A drive mechanism control apparatus, comprising:

a driver;

a drive controller in communication with the driver;

a data generator for generating control data for controlling the driver, and for generating timing data for controlling output timing of the control data to the drive controller, wherein the drive controller controls operation of the driver based on the transmitted control data;

a storage medium for storing the timing data and control data;

a timer for starting a timing operation upon receipt of timing data, and for outputting a time-up signal when a time specified by the timing data elapses;

a direct memory access for reading the timing data from the storage medium, and for sending the read timing data to the timer when activated by a specific signal, and then for sending control data from the storage medium to the drive controller based on the time-up signal output from the timer;

a position detector for outputting a position detection signal when an operating part of the drive mechanism reaches a first reference position; and

a drive confirmation unit for computing a logical operating position of the drive mechanism from the sent control data, for confirming drive mechanism operating status by comparing the logical operating position with the actual operating position based on the position detection signal, and for outputting an operating error signal when a drive operation error is detected.

8. A drive mechanism control apparatus as recited in claim 7, wherein the drive confirmation unit comprises:

a comparison data storage unit in which specific count values are stored;

a counter that is initialized when the operating part is at a second reference position and counts each time the time-up signal is received; and

a comparator for comparing the value of the counter with a specific count value stored in the comparison data storage unit;

wherein the operating status of the drive mechanism is confirmed according to the comparison result of the comparator when the position detection signal is received.

9. A drive mechanism control apparatus as recited in claim 8, wherein the comparison data storage unit comprises:

a first comparison data storage unit for storing an allowable lower limit of a specific count value for measuring movement of the operating part from the second reference position to the first reference position; and

a second comparison data storage unit for storing an allowable upper limit of the specific count value for measuring movement of the operating part from the second reference position to the first reference position;

wherein the drive confirmation unit outputs the operating error signal if the position detection signal is received when the value of the counter is less than or equal to the allowable lower limit or greater than or equal to the allowable upper limit.

10. A drive mechanism control apparatus as recited in claim 9, wherein the drive confirmation unit outputs the operating error signal as an interrupt signal to the data generator, and the data generator performs an error handling process corresponding to the operating error based on the interrupt signal.

11. A drive mechanism control apparatus as recited in claim 7, wherein a stop drive signal for stopping drive mechanism operation is output based on the operating error signal from the drive confirmation unit.

12. A drive mechanism control apparatus as recited in claim 7, further comprising:

a stepping motor;

wherein the timing data includes data for activating the change timing for the stepping motor phase change, a phase pattern for each change timing, and a supply current value for each change timing.

13. A drive mechanism control apparatus as recited in claim 12, further comprising a carriage driven by the stepping motor.

14. A drive mechanism control apparatus as recited in claim 7, further comprising:

a carriage for an ink jet print head;

wherein the drive confirmation unit performs the drive confirmation process when the carriage is driven to accomplish an ink jet head cleaning operation.

15. A drive mechanism control method, comprising steps for:

(a) generating and storing plural types of control data for controlling a driver and plural timing data for sequentially transmitting the plural control data one at a time;

(b) reading first timing data of the plural timing data;

(c) starting a timing operation when the read first timing data is received, and outputting a time-up signal when a time specified by the first timing data elapses;

(d) reading one control data type based on the time-up signal, and sending that control data type to a drive mechanism controller;

(e) reading next timing data of the plural timing data when the control data type read in step (d) is sent to the drive mechanism controller, and repeating steps (c) and (d) for next timing data, another control data type, and another time-up signal; and

(f) repeating step (e) until all of the stored plural timing data has been read.

16. A drive mechanism control method as recited in claim 15, wherein step (d) comprises:

(d1) sequentially and individually reading each type of control data from a first control data type to a last control data type according to the corresponding time-up signal, and sending each read control data type to the controller.

17. A drive mechanism control method as recited in claim 15, wherein the plural timing data comprises phase change timing data for changing the phase of a stepping motor, and one type of control data comprises phase pattern data that is applied to the stepping motor at each phase change and phase current data for controlling current supplied to the motor when the motor phase changes.

18. A drive mechanism control method as recited in claim 15, wherein the plural timing data comprises head drive timing data for controlling the timing of a head drive, and one type of control data comprises head drive trigger data and print data.

19. A drive operation confirmation method for a drive mechanism, comprising steps for:

(a) generating and storing plural control data for accomplishing a specific confirmation drive process and plural timing data controlling the timing of transmission of the plural control data;

(b) driving the drive mechanism by sequentially reading the plural timing data, and sequentially reading and transmitting the plural control data at specific timing intervals, based on the read timing data, to a drive mechanism controller;

(c) calculating a drive amount of the drive mechanism based on the read and transmitted plural timing data and plural control data;

(d) calculating a difference between an actual operating position and a calculated operating position of an operating part of the drive mechanism, based on a position determined from the calculated drive amount and a position determined from a position detection signal; and

(e) outputting an operating error signal when the difference between the calculated operating position and the actual operating position is outside a specific range.

20. A drive operation confirmation method as recited in claim 19, wherein step (c) comprises counting transmissions of control data sent at the specific timing intervals in step (b).

21. A drive operation confirmation method as recited in claim 19, wherein step (e) comprises outputting a stop signal stopping drive mechanism operation when the difference between the calculated operating position and the actual operating position is outside the specific range.

22. A drive operation confirmation method as recited in claim 19, wherein the plural timing data comprises timing data for changing a stepping motor phase pattern and change timing control data for changing the current control data, and the plural control data comprises phase pattern data for each changing timing, and current control data supplied at each change timing.

23. A machine-readable storage medium for storing a computer program for directing a machine to perform a drive mechanism control method, the computer program comprising:

(a) instructions for generating and storing plural types of control data for controlling a driver and plural timing data for sequentially transmitting the plural control data one at a time;

(b) instructions for reading first timing data of the plural timing data;

(c) instructions for starting a timing operation when the read first timing data is received, and outputting a time-up signal when a time specified by the first timing data elapses;

(d) instructions for reading one control data type based on the time-up signal, and sending that control data type to a drive mechanism controller;

(e) instructions for reading next timing data of the plural timing data when the control data type read in (d) is sent to the drive mechanism controller, and repeating (c) and (d) for next timing data, another control data type, and another time-up signal; and

(f) instructions for repeating (e) until all of the stored plural timing data has been read.

24. A machine-readable storage medium as recited in claim 23, wherein (d) comprises:

(d1) instructions for sequentially and individually reading each type of control data from a first control data type to a last control data type according to the corresponding time-up signal, and sending each read control data type to the controller.

25. A machine-readable storage medium as recited in claim 23, wherein the plural timing data comprises phase change timing data for changing the phase of a stepping motor, and one type of control data comprises phase pattern data that is applied to the stepping motor at each phase change and phase current data for controlling current supplied to the motor when the motor phase changes.

26. A machine-readable storage medium as recited in claim 23, wherein the plural timing data comprises head drive timing data for controlling the timing of a head drive, and one type of control data comprises head drive trigger data and print data.

27. A machine-readable storage medium as recited in claim 23, wherein the storage medium comprises a compact disc, floppy disc, hard disk, magnetically recordable tape, or electromagnetic signal.

28. A machine-readable storage medium for storing a computer program for directing a machine to perform a drive operation confirmation method for a drive mechanism, the computer program comprising:

(a) instructions for generating and storing plural control data for accomplishing a specific confirmation drive process and plural timing data controlling the timing of transmission of the plural control data;

(b) instructions for driving the drive mechanism by sequentially reading the plural timing data, and sequentially reading and transmitting the plural control data at specific timing intervals, based on the read timing data, to a drive mechanism controller;

(c) instructions for calculating a drive amount of the drive mechanism based on the read and transmitted plural timing data and plural control data;

(d) instructions for calculating a difference between an actual operating position and a calculated operating position of an operating part of the drive mechanism, based on a position determined from the calculated drive amount and a position determined from a position detection signal; and

(e) instructions for outputting an operating error signal when the difference between the calculated operating position and the actual operating position is outside a specific range.

29. A machine-readable storage medium as recited in claim 28, wherein (c) comprises counting transmissions of control data sent at the specific timing intervals in (b).

30. A machine-readable storage medium as recited in claim 28, wherein (e) comprises outputting a stop signal stopping drive mechanism operation when the difference between the calculated operating position and the actual operating position is outside the specific range.

31. A machine-readable storage medium as recited in claim 28, wherein the plural timing data comprises timing data for changing a stepping motor phase pattern and change timing control data for changing the current control data, and the plural control data comprises phase pattern data for each changing timing, and current control data supplied at each change timing.

32. A machine-readable storage medium as recited in claim 28, wherein the storage medium comprises a compact disc, floppy disc, hard disk, magnetically recordable tape, or electromagnetic signal.

33. A drive mechanism control apparatus, comprising:

driving means;

means for controlling the driving means;

means for generating control data for controlling the driving means, and for generating timing data for controlling output timing of the control data to the driving controlling means, wherein the driving controlling means controls operation of the driving means based on the transmitted control data;

means for storing the timing data and control data;

means for starting a timing operation upon receipt of timing data, and for outputting a time-up signal when a time specified by the received timing data elapses;

first direct memory access means for reading the timing data from the storing means, and for sending the read timing data to the timer when activated by a specific signal; and

second direct memory access means for reading control data from the storing means, and for sending the read control data to the driving controlling means when the time-up signal is received from the timing means.

34. A drive mechanism control apparatus as recited in claim 33, wherein

the data generating means is configured to generate plural timing data and plural control data corresponding to the plural timing data;

the second direct memory access means is configured to output to the first direct memory access means a start signal to cause the first direct memory access means to start reading second timing data after the second direct memory access means completes the sending of control data corresponding to the first timing data to the driving controlling means; and

the first direct memory access means is configured to read the second timing data from the storing means and send the second timing data to the timing means based on the start signal.

35. A drive mechanism control apparatus as recited in claim 34, wherein the second direct memory access means further comprises:

first control means, activated by the time-up signal from the timing means, for reading, from among plural control data stored to the storing means, first control data corresponding to the first timing data each time the time-up signal is received, and for sending the read first control data to the driving controlling means; and

second control means, activated by completion of sending the first control data, for reading, from among the plural control data stored to the storing means, second control data corresponding to the second timing data, for sending the read second control data to the driving controlling means, and then for outputting the start signal to the first direct memory access means.

36. A drive mechanism control apparatus as recited in claim 33, further comprising:

means for imparting motion in a stepping manner;

wherein the timing data comprises timing data for controlling a phase change timing of the motion imparting means, and the control data comprises phase pattern data that is set when the phase of the motion imparting means changes and phase current data for controlling current supplied to the motion imparting means when the phase of the motion imparting means changes.

37. A drive mechanism control apparatus as recited in claim 36, wherein the data generator generates basic timing data, phase pattern data, and phase current data for use during motion imparting means acceleration, deceleration, and constant speed operation, and generates the timing data, first control data, and second control data based on the basic timing data.

38. A drive mechanism control apparatus as recited in claim 33, further comprising:

means for driving a head;

wherein the timing data and control data comprises data controlling head drive timing, drive trigger data for actually driving the head, and print data.

39. A drive mechanism control apparatus, comprising:

driving means;

means for controlling the driving means;

means for generating control data for controlling the driver, and for generating timing data for controlling output timing of the control data to the driving controlling means, wherein the driving controlling means controls operation of the driving means based on the transmitted control data;

means for storing the timing data and control data;

means for starting a timing operation upon receipt of timing data, and for outputting a time-up signal when a time specified by the timing data elapses;

direct memory access means for reading the timing data from the storing means, and for sending the read timing data to the timing means when activated by a specific signal, and then for sending control data from the storing means to the driving controlling based on the time-up signal output from the timing means;

means for outputting a position detection signal when an operating part of the drive mechanism reaches a first reference position; and

drive confirmation means for computing a logical operating position of the drive mechanism from the sent control data, for confirming drive mechanism operating status by comparing the logical operating position with the actual operating position based on the position detection signal, and for outputting an operating error signal when a drive operation error is detected.

40. A drive mechanism control apparatus as recited in claim 39, wherein the drive confirmation means comprises:

comparison data storing means in which specific count values are stored;

counting means that is initialized when the operating part is at a second reference position and counts each time the time-up signal is received; and

means for comparing the value of the counting means with a specific count value stored in the comparison data storing means;

wherein the operating status of the drive mechanism is confirmed according to the comparison result of the comparing means when the position detection signal is received.

41. A drive mechanism control apparatus as recited in claim 40, wherein the comparison data storing means comprises:

first comparison data storing means for storing an allowable lower limit of a specific count value for measuring movement of the operating part from the second reference position to the first reference position; and

second comparison data storing means for storing an allowable upper limit of the specific count value for measuring movement of the operating part from the second reference position to the first reference position;

wherein the drive confirmation means outputs the operating error signal if the position detection signal is received when the value of the counting means is less than or equal to the allowable lower limit or greater than or equal to the allowable upper limit.

42. A drive mechanism control apparatus as recited in claim 41, wherein the drive confirmation means outputs the operating error signal as an interrupt signal to the data generating means, and the data generating means performs an error handling process corresponding to the operating error based on the interrupt signal.

43. A drive mechanism control apparatus as recited in claim 39, wherein a stop drive signal for stopping drive mechanism operation is output based on the operating error signal from the drive confirmation means.

44. A drive mechanism control apparatus as recited in claim 39, further comprising:

means for imparting motion in a stepping manner;

wherein the timing data includes data for activating the change timing for the phase change of the motion imparting means, a phase pattern for each change timing, and a supply current value for each change timing.

45. A drive mechanism control apparatus as recited in claim 44, further comprising means driven by the motion imparting means.

46. A drive mechanism control apparatus as recited in claim 39, further comprising:

driven means for an ink jet print head;

wherein the drive confirmation means performs the drive confirmation process when the driven means is driven to accomplish an ink jet head cleaning operation.